

CLAIMS:

1. A variable lens (100; 200; 300; 500; 600) comprising:
 - a chamber (125) defined by at least one side wall and having an optical axis (90) extending longitudinally through the chamber;
 - the chamber (125) containing a first fluid (130) and a second fluid (140) in contact over a meniscus (150) extending transverse the optical axis (90), the perimeter of the meniscus being constrained by said side wall (125), the fluids (130, 140) being substantially immiscible and having different indices of refraction; and
 - at least one pump (110; 112, 114, 116, 152; 422) arranged to controllably alter the position of the meniscus (150) along the optical axis (90) by altering the relative volume of each of said fluids contained within the chamber.
2. A lens (100; 200; 300; 500; 600) as claimed in claim 1, wherein the pump (110; 112, 114, 116, 152; 422) operates utilising at least one of: electro-capillary, differential-pressure electro-capillarity, electrowetting, continuous electrowetting, electrophoresis, electroosmosis, dielectrophoresis, electrohydrodynamic pumping, thermocapillary, thermal expansion, dielectric pumping, mechanic pumping or variable dielectric pumping.
3. A lens (100; 200; 300; 500; 600) as claimed in any one of the above claims, wherein the wettability of the internal surface (120) of the chamber (125) varies longitudinally.
4. A lens (100; 200; 300; 500; 600) as claimed in any one of the above claims, wherein the wettability of the internal surface (120) of the chamber (125) is arranged to be controllably altered by the electrowetting effect.
- 25 5. A lens (100; 200; 300; 500; 600) as claimed in any one of the above claims, wherein the chamber (125) has a circular cross-section.

6. A lens (100; 200; 300; 500; 600) as claimed in any one of the above claims, wherein at least one of the side walls defining the interior surface (120) of the chamber (125) is not parallel to the optical axis (90).

5 7. A lens (100; 200; 300; 500; 600) as claimed in any one of the above claims, wherein the lens is a zoom lens.

8. An optical device (1; 400) comprising a variable lens (100; 200; 300; 500; 600), the lens comprising:

10 - a chamber (125) defined by at least one side wall and having an optical axis (90) extending longitudinally through the chamber;
- the chamber (125) containing a first fluid (130) and a second fluid (140) in contact over a meniscus (150) extending transverse the optical axis (90), the perimeter of the meniscus being constrained by said side wall, the fluids being substantially immiscible and
15 having different indices of refraction; and
- at least one pump (110; 112, 114, 116, 152; 422) arranged to controllably alter the position of the meniscus (150) along the optical axis (90) by altering the relative volume of each of said fluids contained within the chamber.

20 9. An optical device as claimed in claim 8, wherein the device is an optical scanning device (1) for scanning an information layer (4) of an optical record carrier (2), the device comprising a radiation source (11) for generating a radiation beam (12, 15, 20) and an objective system (18) for converging the radiation beam on the information layer (4).

25 10. An optical device as claimed in claim 8, wherein the device is a variable focus image capture device (400).

11. A method of manufacturing a variable lens (100; 200; 300; 500; 600), the method comprising:

30 - providing a chamber (125) defined by at least one side wall and having an optical axis (90) extending longitudinally through the chamber;
- providing a first fluid (130) and a second fluid (140) in the chamber (125) such that the fluids (130, 140) are in contact over a meniscus (150) extending transverse the optical axis (90), the perimeter of the meniscus (150) being constrained by said side walls

(125), the fluids (130, 140) being substantially immiscible and having different indices of refraction; and

- providing at least one pump (110; 112, 114, 116, 152; 422) arranged to controllably alter the position of the meniscus along the optical axis by altering the relative 5 volume of each of said fluids contained within the chamber.

12. A method of manufacturing an optical device (1; 400), the method comprising the steps of:

- providing a variable lens, the variable lens comprising:
- 10 - a chamber (125) defined by at least one side wall and having an optical axis (90) extending longitudinally through the chamber ;
- the chamber (125) containing a first fluid (130) and a second fluid (140) in contact over a meniscus (150) extending transverse the optical axis (90), the perimeter of the meniscus (150) being constrained by said side walls (90), the fluids (130, 140) being 15 substantially immiscible and having different indices of refraction; and
- at least one pump (110; 112, 114, 116, 152; 422) arranged to controllably alter the position of the meniscus along the optical axis by altering the relative volume of each of said fluids contained within the chamber.